

II. REMARKS

Claims 1-19 are pending. Claims 18 and 19 have been withdrawn because they pertain to a non-elected invention. However, Applicants contend that because non-elected claims 18 and 19 are dependent upon independent claim 1, they should be rejoined with the allowed claims when claim 1 is allowed.

Claims 1-3, 5-7 and 9-19 have been amended by the present paper. Specifically, claims 1, 2, 5, 6 and 9-19 have been amended to replace “general formula” with merely -- formula--. This amendment has absolutely no further limiting effect on the scope of the claims.

Claims 1, 3 and 7 have been amended to replace “basic compound” with --alkali metal hydroxide-- as supported on page 12, lines 25-28, of Applicants’ specification as originally filed. Independent claims 1 and 10 have also been amended to recite “filtering the mixture obtained in step (b) to separate an aqueous phase and a solid phase, thereby separating the endo isomer from the exo isomer” as supported on page 23, lines 11-27, of Applicants’ specification as originally filed.

The present amendment adds no new matter to the above-captioned application.

A. The Invention

The present invention pertains broadly to a method of separating an endo isomer and an exo isomer of a dicarboxylic acid, such as may be used as raw materials for making agricultural chemicals or in industry. The endo isomer and exo isomer of dicarboxylic acid are known to have different melting points and reactivity.

Thus, in accordance with an embodiment of the present invention, a method of separating an endo isomer and an exo isomer of a dicarboxylic acid is provided that includes steps recited by independent claim 1. In accordance with another embodiment of the present invention, a method of separating an endo isomer and an exo isomer of a dicarboxylic acid is provided that includes steps recited by independent claim 10. Various other embodiments, in accordance with the present invention, are recited by the dependent claims.

An advantage provided by the various embodiments, in accordance with the present invention, is that a method for extracting a high-purity stereoisomer from a mixture of endo isomer and exo isomer of dicarboxylic acid is provided. In accordance with the embodiment of claim 1 of the present invention, a method for separating an endo isomer and an exo isomer of a dicarboxylic acid is provided wherein the endo isomer is separated from the exo isomer using sodium hydroxide by utilizing the difference in solubility between a neutralized salt of the endo isomer and a neutralized salt of the exo isomer of a dicarboxylic acid having a norbornene or norbornane structure. In accordance with the embodiment recited by claim 10 of the present invention, a method for separating an endo isomer and an exo isomer of a salt of a dicarboxylic acid is provided, wherein the endo isomer is separated from the exo isomer by utilizing the difference in solubility between a salt of the endo isomer and a salt of the exo isomer of a dicarboxylic acid having a norbornene or norbornane structure.

B. The Rejections

Claims 1-17 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly indefinite.

Claims 1-17 stand rejected under 35 U.S.C. § 102(a) as allegedly anticipated by Zhao et al. (U.S. Patent 6,465,551, hereafter, the “Zhao Patent”).

Applicants respectfully traverse the Examiner’s rejections and request reconsideration of the above-captioned application for the following reasons.

C. Applicants’ Arguments

In view of the present amendment, claims 1-19 are in compliance with 35 U.S.C. § 112.

i. The Section 102 Rejection

Anticipation under 35 U.S.C. § 102 requires showing the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick, 221 U.S.P.Q. 481, 485 (Fed. Cir. 1984). In this case, the Examiner has failed to establish a prima facie case of anticipation against Applicants’ claimed invention because the Zhao Patent does not teach, or suggest, (i)

“providing a mixture comprising mainly the endo isomer of the dicarboxylic acid represented by formula (1) or (2) or an anhydride thereof, and the exo isomer of the dicarboxylic acid represented by formula (1) or (2) or an anhydride thereof,”

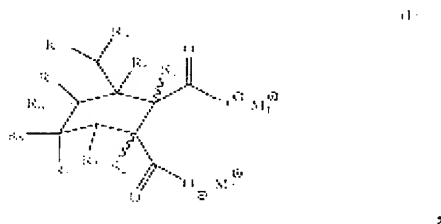
as recited by independent claim 1, and (ii)

“providing a mixture comprising mainly the endo isomer of the salt of the dicarboxylic acid represented by formula (1) or (2), and the exo isomer of the salt of the dicarboxylic acid represented by formula (1) or (2),”

as recited by independent claim 10. The Zhao Patent also does not teach, or suggest, (iii) “filtering the mixture obtained in step (b) to separate an aqueous phase and a solid phase, thereby separating the endo isomer from the exo isomer” as recited by claims 1 and 10.

ii. The Zhao Patent

The Zhao Patent discloses “bicyclo[2.2.1]heptane dicarboxylate salts as polyolefin nucleators,” which pertain to compounds and compositions comprising specific metal salts of bicyclo[2.2.1]heptane dicarboxylate salts in order to provide desirable properties within polyolefin articles (See Abstract of the Zhao Patent). The salts and derivatives of the compounds disclosed by the Zhao Patent are allegedly useful as nucleating and/or clarifying agents for polyolefin, provide excellent crystallization temperatures, stiffness, and calcium stearate compatibility within target polyolefin, exhibit very low hygroscopicity and, therefore, have excellent shelf stability as powdered or granular formulations (See Abstract of the Zhao Patent). More specifically, the Zhao Patent discloses saturated metal or organic salts of bicyclic dicarboxylates, preferably, bicyclo[2.2.1]heptane-dicarboxylates, and most preferably of a compound conforming to Formula (I):



wherein M_1 and M_2 are the same or different and are independently selected from the group consisting of metal or organic cations, and $R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8, R_9$, and R_{10} are individually selected from the group consisting of hydrogen, $C_1 - C_9$ alkyl, hydroxy, $C_1 - C_9$ alkoxy, $C_1 - C_9$ alkyleneoxy, amine, and $C_1 - C_9$ alkylamine, halogen, phenyl, alkylphenyl,

and geminal or vicinal C₁–C₉ carbocyclic (Zhao Patent, col. 4, lines 33-56). The Zhao Patent discloses that, preferably, the metal cations are selected from the group consisting of calcium, strontium, barium, magnesium, aluminum, silver, sodium, lithium, rubidium, and potassium (Zhao Patent, col. 4, lines 56-59).

However, the Zhao Patent does not teach, or even suggest, (i)

“providing a mixture comprising mainly the endo isomer of the dicarboxylic acid represented by formula (1) or (2) or an anhydride thereof, and the exo isomer of the dicarboxylic acid represented by formula (1) or (2) or an anhydride thereof,”

as recited by independent claim 1, and (ii)

“providing a mixture comprising mainly the endo isomer of the salt of the dicarboxylic acid represented by formula (1) or (2), and the exo isomer of the salt of the dicarboxylic acid represented by formula (1) or (2),”

as recited by independent claim 10. In Example 3, the Zhao Patent disclosed adding sodium hydroxide (i.e., an alkali metal hydroxide) to a suspension of an endo isomer, namely, endo-bicyclo[2.2.1]hept-5-ene-2,3-dicarboxylic anhydride (Zhao Patent, col. 7, lines 56-67).

However, as would be immediately understood by a person of ordinary skill in the art, this suspension contains only the endo isomer and is not a mixture of endo isomer and exo isomer (See Rule 1.132 Declaration by Tetsuro Yamanaka, filed herewith, and hereinafter referred to as the “Yamanaka Declaration,” ¶¶ 7 and 8). Thus, Zhao’s Example 3 does not teach, or suggest, a mixture of endo isomer and exo isomer, such as is recited by step (a) of claims 1 and 10 of the above-captioned application. In fact, the Zhao Patent discloses that when sodium hydroxide is added to the endo isomer, the result is “[a] clear, homogenous solution... Water was removed in vacuum...” (Zhao Patent, col. 7, lines 61-67). This passage of the Zhao Patent shows, in my opinion, that the endo isomer is dissolved with sodium hydroxide, and then water is removed to obtain a crystalline product. However, the Zhao

Patent does not teach, or suggest, in Example 3 separation of an endo isomer and an exo isomer (Yamanaka Declaration, ¶ 8). Therefore, Example 3 of the Zhao Patent cannot anticipate the subject matter of claims 1 and 10 because it does not disclose a mixture of endo isomer and exo isomer, and it does not teach, or suggest, separating the endo isomer from the exo isomer as claimed (Yamanaka Declaration, ¶ 8).

In Example 2 of the Zhao Patent, Zhao discloses mixing calcium chloride dihydrate to a solution of disodium bicyclo[2.2.1]heptane-2,3-dicarboxylate (Zhao Patent, col. 7, lines 41-55). The Zhao Patent does not teach, or suggest, adding sodium hydroxide to disodium bicyclo[2.2.1]heptane-2,3-dicarboxylate (Yamanaka Declaration, ¶ 9). Furthermore, the Zhao Patent does not disclose that the solution employed in Example 2 is a mixture of an endo isomer and an exo isomer (Yamanaka Declaration, ¶ 9). In addition, even assuming the mixture used in Example 2 were a mixture of endo isomer and an exo isomer (which is an invalid assumption), the Zhao Patent does not disclose the separation of endo isomer from exo isomer (Yamanaka Declaration, ¶ 9).

For all of the above reasons, the Zhao Patent not only fails to teach, or suggest, providing a mixture of endo isomer and exo isomer, but the Zhao Patent also fails to teach, or suggest, (iii) “filtering the mixture obtained in step (b) to separate an aqueous phase and a solid phase, thereby separating the endo isomer from the exo isomer” as recited by claims 1 and 10.

To demonstrate that the Zhao Patent does not teach, or suggest, the separation of endo isomer from exo isomer, Applicants file herewith experimental data obtained by Tetsuro Yamanaka, who is one of the co-inventors of the claimed subject matter of the present application (Yamanaka Declaration, ¶¶ 10-15). The experimental evidence shows that by

individually mixing endo isomer with calcium chloride, and by individually mixing endo isomer with calcium chloride, in solution, the result is for each of the endo isomer and the exo isomer is a solid phase (Yamanaka Declaration, ¶¶ 10-14). Consequently, if the endo isomer and exo isomer were mixed together, and then calcium chloride was added, then the result would be both endo isomer and exo isomer adsorbed with calcium chloride in the solid phase (Yamanaka Declaration, ¶¶ 13 and 14). Therefore, it would not be possible to separate out the endo isomer from the exo isomer by adding calcium chloride to a solution containing both the endo isomer and the exo isomer and then filtering the solution because both the endo isomer and the exo isomer would be mixed together in the solid phase (Yamanaka Declaration, ¶ 14).

III. CONCLUSION

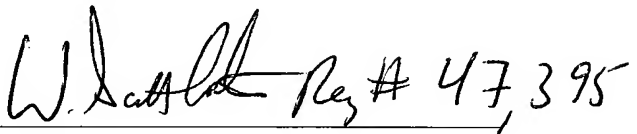
In view of the present amendment, claims 1-17 are in compliance with 35 U.S.C. § 112. Furthermore, the Examiner has failed to establish a prima facie case of anticipation, or of obviousness, against claims 1-17 because the Zhao Patent does not teach, or suggest, “filtering the mixture obtained in step (b) to separate an aqueous phase and a solid phase, thereby separating the endo isomer from the exo isomer” as recited by independent claims 1 and 10.

For all of the above reasons, claims 1-17 are in condition for allowance, and a prompt notice of allowance is earnestly solicited. Furthermore, upon allowance of independent claim 1, Applicants contend that withdrawn claims 18 and 19 should be rejoined with the allowed claims because claims 18 and 19 are dependent upon claim 1.

Questions are welcomed by the below-signed attorney for Applicants.

Respectfully submitted,

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